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Managing Information Technology Infrastructure Capability for international Business Operations

Marianne Broadbent
The University of Melbourne

Carey Butler
The University of Melbourne

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Marianne Broadbent
Melbourne Business School
The University of Melbourne
E-mail: m.broadbent@mbs.unimelb.edu.au

Carey Butler
Melbourne Business School
The University of Melbourne
E-mail: c.butler@mbs.unimelb.edu.au

Executive Summary
The management of information technology can be a key enabler or inhibitor for firms with significant international business operations. Multi-national companies (MNCs) face constant challenges in determining both what information technology capabilities are appropriate and how these should be deployed.

This paper reports results from a two phase study exploring the link between the international business orientations of firms and different patterns of information technology (IT) infrastructure capabilities. The study sought to identify whether different types of capabilities were evident in different types of firms, and how these were developed and sustained.

A two-phased case study approach was used for the research which involved onsite questionnaire-based interviews with senior IT and business executives in manufacturing and finance/banking firms. Phase 1 of the study involved indepth fieldwork in four large Australian firms with extensive international business operations. Data derived from this initial work was used to develop a series of research propositions which provided the focus for Phase 2 activities. Phase 2 involved a fieldwork investigation of 22 MNCs headquartered in Singapore, Hong Kong, Japan and North America. Data collected during this phase was used to test the research propositions and to formulate a case study vignette for each firm.

Research results revealed that firms with a *global* orientation emphasised customer service and extensive IT infrastructure capability, *transnational* firms emphasised innovation and had selective IT infrastructure capability, while *international* firms valued flexibility and had limited IT infrastructure capabilities. The firms had different patterns of IT management and had developed a range of management mechanisms to cope with the challenges of identifying and sustaining appropriate IT capabilities. This included one or more high level planning and decision-making committees with overlapping business and IT management membership.

The links between firm characteristics and appropriate IT infrastructure capability is presented in a framework which can be used to track the IT management demands and constraints of the firm. The firm's business strategy emphasis, the international-local responsiveness balance, and business synergies lead to a predominant international business orientation which in turn has implications for IT configuration and approaches to international IT management. The IT management context is constrained by the availability of both IT components and skills and complemented by a series of management mechanisms. Governance, investment, balancing and integrating mechanisms are integral to implementing and sustaining IT infrastructure capabilities which in turn support and enable the firm's strategic context. Underlying complexity factors include the range of cultural contexts, the extent of international differentiation and issues associated with geographic dispersion.

The results and framework underscore the importance of taking a holistic and consistent perspective in linking business needs and IT capabilities to achieve the support required for specific international business environments.

Abstract
The management of information technology can be a key enabler or inhibitor for firms with significant international business operations. Multinational companies face constant challenges in determining both what information technology capabilities are appropriate and how these should be deployed.

This paper explores the link between the international business orientation of firms and different patterns of IT infrastructure capabilities. Following initial detailed work in four firms, 22 firms headquartered in Singapore, Hong Kong, Japan and North America provided the basis for the field investigation. We examined the extent to which firms with differences in strategic orientations, business strategy emphases, and international integration and local responsiveness pressures, developed different patterns of IT infrastructure capabilities. We found that firms with a global orientation emphasised customer service and extensive IT infrastructure capability, transnational firms emphasised innovation and had selective IT infrastructure capability, while international firms emphasised flexibility and had limited IT infrastructure capabilities. The firms had different patterns of IT management and developed a range of management mechanisms to cope with the challenges of identifying and sustaining appropriate IT capabilities.

1. Continuing Challenges Of International Business

Information Technology (IT) infrastructure capability is critical to globally competing firms (IS Analyzer 1991, Clemons, Row & Venkateswaran 1989, Neo 1991) and is a major business resource for attaining sustainable competitive advantage (Keen 1991, McKenney 1995). The development of an appropriate IT infrastructure has been a major concern of IS management in many countries throughout this decade (Niederman, Brancheau & Wetherbe 1991, CSC Index 1994, Broadbent, Butler & Hansell 1994, Brancheau, Janz & Wetherbe 1996, Watson & others 1996) and is a particular challenge to both business and IS management in developing global enterprises (Thompson, Faigle & Short 1987, Alavi & Young 1990, Karimi & Konsynski 1991).

In this paper we explore the links between the different types of international business orientations and firms' patterns of IT infrastructure capabilities. Our goal is to better understand how firms with extensive international operations develop and manage IT capabilities suited to their strategic context. Following initial work in four Australian-headquartered firms, we conducted a field investigation of 22 firms headquartered in Singapore, Hong Kong, Japan and North America. We examined the extent to which firms with differences in strategic orientations, business strategy emphases, and pressures to balance international integration and local responsiveness, developed different patterns of IT infrastructure capabilities. The research used a combination of qualitative and quantitative data collection approaches and involved both written responses and onsite interviews with senior business and IT managers in the firms. Our interest was in identifying and understanding what capabilities existed, why they existed, and how they were developed and sustained. We identified a range of management mechanisms used by firms to cope with the difficulties of matching complex and often competing demands to achieve IT infrastructure which was acceptable from both a cost and capability level standpoint.

We first outline pertinent international business and IT infrastructure literature to provide the conceptual basis for the study. The two phase research approach is outlined, together with the propositions which guided the data collection. We discuss the findings in two ways: first the data linking aspects of international business orientation and IT infrastructure capabilities and second, the management mechanisms we observed which helped firms to identify and sustain infrastructure capabilities which matched their strategic context. In the discussion we revisit the difficulties of effectively utilising IT in multi-national companies (MNC)[1] and conclude with recommendations for both research and practice.

2. Managing It And International Business Operations

Information technology and systems have long been recognised as a management mechanism integral to a company's shift from a national to a global strategy (Mandell 1975, Mandell & Grub 1979, Doz & Prahalad 1981) but the focus of concerns has been sporadic, uneven and eclectic (Cheung & Burn 1995). The appropriateness of transplanting domestic systems into non-domestic locations (Buss 1982, Selig 1983) has been questioned, with differences in management approaches, cultural contexts and project coordination cited as reasons adopt a more contingent perspective (Mandell & Grub 1979, Buss 1982, Daniels & Frost 1988, Allen & Boynton 1991). The well documented challenge of achieving strategic alignment (Venkatraman, Henderson & Oldach 1993) is even greater for MNCs which operate on multiple sites in two or more countries (Selig 1983, Egelhoff 1991, Ives, Jarvenpaa & Mason 1993). Determining international

[1] Throughout this paper the term 'MNC' is used to describe companies who operate on multiple sites in two or more countries. This term is preferred to 'global' which is more common in the IT management literature. In the mind of the researchers, global implies a worldwide presence and at least an intent to compete in as many countries as possible. Our experience is that many firms who have extensive operations outside their domestic base do not see themselves as 'competing globally'. Rather they have a strategy of competing in selected countries, in selected markets with selected products and services. The term 'MNC', implying between and across nations, captures the reality in a more generic way than does the term 'global' and is the accepted term in the international management literature (Bartlett & Ghoshal 1992). The activities undertaken by an MNC outside its domestic base is referred to as 'international business operations'.

versus local IT requirements remains an ongoing concern (Huff 1991, Ives & Jarvenpaa 1991), and the implementation of appropriate IT strategies and systems has lagged, rather than led MNC corporate strategy (Roche 1992).

Four distinct strategic orientations for managing organisations across borders have been identified (Bartlett & Ghoshal (1989,1992): *multinational, international, global* and *transnational.* The *multinational* orientation firm is characterised by strong national bases which exhibit local autonomy. In contrast, the *international* orientation describes firms whose strategic focus is on worldwide diffusion. The *transnational* orientation typically involves firms concerned with attaining global efficiency and flexibility, and promoting organisational learning, while the *global* orientation firm has a strong focus on seeking cost advantages.

These MNC strategy-structure arrangements have a symbiotic relationship with the information processing capacities of the firm (Egelhoff 1982, Alavi & Young 1990). Four structural configurations for IT management[2] arrangements in an MNC match each these strategic orientations (Ives & Jarvenpaa 1991). This match is summarised in *Figure 1.* The *multinational* orientation logically leads to independent IT operations, the *international* to an intellectual synergy configuration, the *global* to a headquarters driven configuration and the *transnational* to an integrated IT configuration. However, in nearly 50% of firms, the IT configuration is inconsistent with the strategic orientation in terms of business structure due to a complex set of managerial, human resource, and industry factors (Jarvenpaa & Ives, 1993).

Figure 1: Strategic Orientations and IT Configurations

ORIENTATION	STRATEGIC FOCUS	FIRM CONFIGURATION	IT CONFIGURATION
GLOBAL	Cost advantages	Centralised assets, capabilities	Centralised, headquarters - driven IT operations
TRANSNATIONAL	Global Efficiency + Flexibility, Learning	Complex balance, interdependent + dispersed	Integrated & synergistic IT operations
INTERNATIONAL	Worldwide Diffusion + Adaption of Parent Company	Mix of centralised + decentralised, based on core competencies	Selective synergy in IT operations
MULTINATIONAL	Strong national bases, Local autonomy	Decentralised assets, nationally self-sufficient	Decentralised & independent IT operations

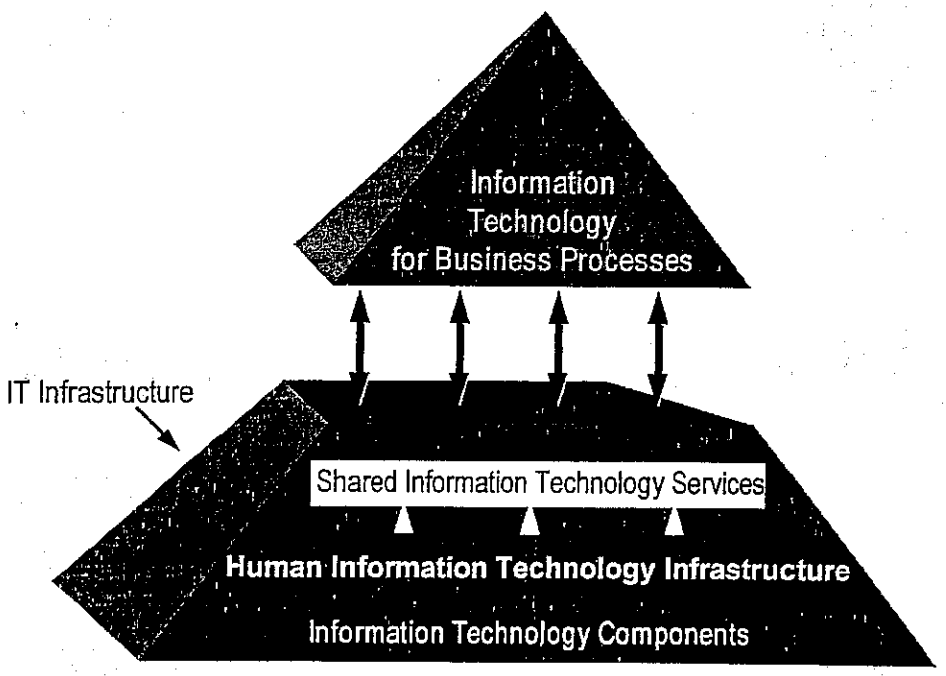
Different balances between the pressures for international integration and local responsiveness (Prahalad & Doz 1987) in each of the four business environments reflect different requirements for sharing and processing information (Egelhoff 1991, Karimi & Konsynski 1991), such as products, services and customers, different structural configurations, and need to be placed in the context of individual companies and their management (Hessler 1993). Appropriate approaches to the coordination and delivery of information systems need to take account of the extent and nature of multiple geographic sites and technological, linguistic and cultural contexts (Hofstede 1984, Hall & Hall 1990, O'Hara-Devereaux & Johansen 1994). These characteristics involve understanding the variations between international and local IT infrastructure requirements and applying the concepts of infrastructure and architecture to achieve a rational balance between allocating and deploying international and local strategies and resources (Alavi & Young 1990). However, many unanswered questions remain concerning the deployment of IT infrastructure for international business (Roche 1996).

[2] IT management is defined as the managerial efforts associated with planning, organizing, controlling and directing the introduction and use of IT within an organisation (Boynton & Zmud 1987).

3. IT Infrastructure Capabilities

While our knowledge of the value of IT infrastructure remains largely *'in the realms of conjecture and anecdote'* (Duncan 1995:39), recent progress has been made in identifying the dimensions of IT infrastructure (Weill & others 1995), and the notion of IT infrastructure capability (Broadbent & others 1996). IT infrastructure is the base foundation for budgeted-for IT capability (both technical and human), shared throughout the firm in the form of reliable services, and usually managed by the IS group (Weill 1993, Broadbent & others, 1996). This IT capability includes both the internal technical (equipment, software and cabling) and human expertise required to provide reliable services (McKay & Brockway 1989, Weill 1993, Weill, Broadbent & St Clair 1996). The elements of IT infrastructure are depicted in the model presented in *Figure 2* (Weill & others, 1995, drawing on the notion of the base foundation defined by McKay & Brockway, 1989).

Figure 2: The Elements of IT Infrastructure



Key attributes of IT infrastructure capability are the extent to which it is shareable and reusable across the firm (Duncan 1995). Twenty-three firm-wide infrastructure services have been identified in large firms (Weill & others 1995) and the notion of IT infrastructure capability has been developed using the prevalence and nature of these services (Broadbent & others 1996) in tandem with the concept of reach and range (Keen 1991, Keen & Cummins 1994). These services (refer *Figure 3*), are grouped into core and additional services, indicating the extent of their existence in 25 large firms.

Figure 3: IT Infrastructure Services

	% of Firms*
5 Core IT Infrastructure Services	
1. Management of corporate communication network services	100
2. Management of group-wide or firm-wide messaging services	100
3. Recommend standards for at least one component of IT architecture(e.g. hardware, operating systems, data, communications)	100
4. Security, disaster planning and business recovery services for firm-wide installations and applications	100
5. Technology advice and support services	100
18 Additional IT Infrastructure Services	
6. Management, maintenance, support of large scale data processing facilities (e.g. mainframe operations)	96
7. Management of group-wide or firm-wide applications and databases	96
8. Performing IS project management	88
9. Data management advice and consultancy services	84
10. Providing IS planning for business units	80
11. Enforcement of IT architecture and standards	76
12. Management of business-unit specific networks (e.g. LANs)	76
13. Managing and negotiating with suppliers and outsourcers	76
14. Identification and testing of new technologies for business purposes	72
15. Development of business-unit specific applications (usually on a chargeback or contractual basis)	68
16. Implementation of security, disaster planning and recovery for business units	60
17. Electronic provision of management information (e.g. EIS)	56
18. Management of business-unit specific applications	56
19. Group-wide or firm-wide data management, including standards	52
20. Development and management of on-line and/or EDI linkages to suppliers or customers	52
21. Development of a common systems development environment	52
22. Technology education services (e.g. training)	36
23. Multi-media operations and development (e.g. video-conferencing)	16

From Broadbent & others, 1996

Central to many of these services are the IT components and human perspectives which continue to create IT management challenges in managing international operations. These include:

- The complex and frustrating task of establishing an appropriate telecommunications network (Nolan Norton 1990, Deans & others 1991, Huff 1991, Karimi & Konsynski 1991, O'Hara-Deveraux & Johansen 1994) which often involves consideration of the quality and extent of local telephony, political constraints restricting network management options (Steinbart & Nath 1992, Keen & Cummins 1994), concerns about privacy, and implications for limiting local employment opportunities (Huff 1991)
- The legal and political restrictions of transborder data flows (TDF) (Kefalas 1992)
- Data management challenges (Hagstrom 1990, Deans & others 1991, King & Sethi 1992) in coordinating local variations in a firm's value chains (Ives & Jarvenpaa 1991, Manheim 1992, Konsynski & Karimi 1993)
- The emergence of new architectures which change the dynamics of centralisation vis-a-vis distributed systems (Roche 1996)
- Hardware and software availability and incompatibilities (Karimi & Konsynski 1991, Steinbart & Nath 1992) with the same vendor and consistent policies across different countries (Ives & Jarvenpaa 1991)

The conversion of these IT components into appropriate and useful infrastructure services by human expertise is influenced by:

- Access to skilled IT and vendor support staff (Ives & Jarvenpaa 1991, Cash et al 1992)
- Diverse approaches to applications development and implementation across different countries (Dagwell & Weber 1983, Kumar & Bjorn-Andersen 1990, Sauter 1992, Shore & Venkatachalam 1996) due to different cultural contexts (Porter 1972, Copeland & Griggs 1985, Couger, Borovits & Zviran 1989), and greater complexity in project management requiring deeper consideration of issues of relationships, power, culture and regulations (Tractinsky & Jarvenpaa 1995)
- Consideration of the characteristics of end users (Ein-Dor & Segev 1992), and the use of IT (Grover, Segars & Durand 1994) in specific cultural environments

When competing in multiple markets, firms face additional problems in combining both efficiency and economies of scale with flexibility and speed (Allen & Boynton 1991), in identifying appropriate architectures (Gibson 1994), and in trade-offs between production, coordination and vulnerability costs in divergent requirements (Sankar, Apte & Palvia 1993). These problems are perceived differently by firms in the services and manufacturing industries (Deans & others 1991).

There is some sound conceptual work examining the implications of international business for IT management (Alavi & Young 1990, Neo 1991, Roche 1996), as well as informed and thoughtful work on globally networked organisations of the future (for example, Jarvenpaa & Ives 1994). However there is a paucity of directly relevant empirical research (King & Sethi 1992, Steinbart & Nath 1992, Gibson 1994, Cheung & Burn 1995) which illuminates how MNCs develop and manage their IT capabilities in the different and complex circumstances of international business operations (Ives & Jarvenpaa 1993). In our work we aimed to identify empirically the nature of IT infrastructure capability in firms which took different approaches to their international business operations.

4. Research Approach

This study explored the nature of the links between different types of international business orientations and patterns of IT infrastructure capabilities. We aimed to identify whether different types of capabilities were evident in different types of firms, and how these were developed and sustained.

The questions which guided our research were:

1. To what extent do firms with different approaches to international business have different patterns of IT infrastructure capability?
2. How do firms with extensive international business operations develop and sustain appropriate IT infrastructure capabilities?

While research into international business approaches has developed considerably over the past ten years, the study of IT infrastructure capability is in its formative stages (Duncan 1995, Broadbent & others 1996). The combination of these two fields represents complex phenomena in an area of dynamic change where researchers aim to capture the experiences of practitioners and develop theories from this (Benbasat, Goldstein & Mead 1987). As such, the research is exploratory; the literature base does not yet lend itself to well grounded hypotheses; terminology is not yet clearly defined and understood, and theory is at an early and formative stage. Thus the research approach was based on case study design, where complex questions can be examined in context and real-life settings, drawing on multiple sources of evidence (Yin 1981). The objective was to identify linkages between aspects of international business and IT infrastructure capabilities and to better understand how these linkages are developed and sustained. Multiple case design provided the basis for a structured field investigation to study emerging and complex phenomena (Eisenhardt 1989, Yin 1994) to understand the context and specific situation of firms. Our approach was a two-phased study based on onsite visits to a select number of firms headquartered in different countries using multiple sources of data collection. Phase 1 (April 1994-September 1995) helped us to shape a series of propositions which then became the focus of Phase 2 (June 1995-June 1996).

Propositions

The following propositions which relate to the first research question were derived from the literature and the experiences of Phase 1.

1. *Firms with different international business orientations will have different business strategy emphases.*
2. *The international business orientation of firms will match their IT configurations.*
3. *Finance and manufacturing firms will differ in their IT infrastructure capability*
4. *Firms with different international business orientations will have different patterns of IT infrastructure capability.*
5. *Firms with different IT configurations will have different patterns of IT infrastructure capability.*

On the basis of the evidence of Phase 1 we expected that firms would have a diverse range of management mechanisms to develop and sustain appropriate links between their approach to international business and their IT infrastructure capabilities. However we anticipated that these would be difficult to classify and thus took a less structured approach with regard to the second research question.

5. Data Collection

Selection of the Firms

We sought to include a select number of firms who had extensive international business operations, and who were major competitors in the finance and manufacturing industries. These two industries are at the forefront of change in industry structure due to the combination of technological innovation and the accelerating pace of globalization (Bradley, Housman & Nolan 1993), but face different drivers for international operations (Yip 1989, Deans & others 1991). While they are heavily reliant on information technology, they provide a

contrast in their strategic use of information and information technology (Porter & Millar 1985; Johnson & Carrico 1988; Cash, McFarlan, McKenney & Applegate 1992). Our measure of *'extensive international business operations'* was based on firms generating at least 20% of revenues from non-domestic operations, and having an ongoing commitment to extending operations in non-domestic locations. In the manufacturing area this meant plants located in countries other than the domestic base, and in finance, it meant conducting full business operations from non-domestic locations.

As much of the pertinent literature which links international business operations and IT was based on the experiences of firms headquartered only in North America, we decided to complete a substantial portion of the case analysis in firms headquartered in other countries, including non-Western countries. Phase 1 of the study was undertaken in four firms headquartered in Australia (the researchers' home country), where we had ready access to multiple executives, internal documentation, and access to many non-domestic locations. Singapore, Hong Kong and Japan were chosen as countries which were very competitive and with a high degree of sophistication in the way IT was deployed (at least in their domestic bases). Thus the firms involved in the second phase of empirical research were headquartered in Singapore, Hong Kong and Japan, and North America[3].

Phase 1

The intent of Phase 1 was to complement the literature analysis by examining pertinent issues related to IT management, particularly the nature of IT infrastructure capabilities, from the perspective of business managers and IT practitioners. Phase one involved multi-site fieldwork with four (2 finance, 2 manufacturing) of Australia's Top 20 firms (see *Appendix 1* for details). This phase clarified issues from the perspective of the firms, helped specify the propositions, and enabled development of data collection techniques to ensure maximum value from time spent with senior business and IT managers. It was decided to identify firms for Phase 2 which were other than *multinational* in international business orientation, as the nature of IT infrastructure capability is such that firms with a *multinational* business orientation would be least likely to require and develop IT infrastructure capability (Alavi & Young 1990).

Phase 2

In the second and major phase, we studied 5 or 6 firms in each region to provide a range of experiences, while minimising acknowledged logistical problems (Jarvenpaa & Ives 1993). The candidate firms were identified using local expertise (eg: host institution academic staff, Treasury economic counsellors from the researchers' domestic base stationed in the Asian countries, major vendors and senior consultants). Table 1 summarises the industries and headquarters location of the firms, which ranged in size from 2,000 to over 90,000 employees, together with indicative information about the sizes of firms in each location. Each firm was a major competitor in its industry within its domestic base, as well as having a significant international presence.

3 Singapore, Hong Kong, Japan and the USA constitute the world's four most competitive nations (World Economic Forum report, South China Morning Post, 6 September 1995). We included one firm headquartered in Canada which is a major competitor in the US market, and which was a research site in a previous study. Thus we have used the term North American firms.

Table 1: Phase Two Firms

	Manufacturing	Finance
Singapore	2	3
Hong Kong	4	2
Japan	3	2
North America	3	3
Total	12	10

Data Collection

In each firm we aimed to have two senior managers involved in the data collection process: an IT executive who had firm-wide responsibilities for managing IT both domestically and internationally (usually the CIO or equivalent); secondly, a business executive with firm-wide responsibilities for managing the business both domestically and internationally (usually the head of 'international' where the firm was organised in that way, or the CFO, or head of marketing or planning internationally). These *key informants* (Phillips 1981) were chosen because they had special and specific knowledge of the firm, and/or the role of both international operations and IT in that firm.

Data for the study was collected using four sources:

1. Pre-interview response forms completed by IT and Business executives
2. Semi-structured interview of IT and business executives
3. Post-interview response form completed by IT and Business executives
4. Internal company documentation (reports, plans) together with publicly available information (eg Annual Reports)

Each interviewee was sent a three page response form prior to interview and was left with a further set of supplementary questions at the conclusion of the interview (to be forwarded to the researchers on completion). The questions in pre-response forms contained several of the same questions to verify information from more than one source. The use of both written response forms and interview sessions achieved several purposes: first, it maximised the time available with the interviewees as preliminary information was obtained prior to the session; second, it allowed more time for contextual probing and questioning of the whys and hows of the firm's strategy and international operations; third, both the pre and post-interview forms contained questions drawn from previous research where constructs were sufficiently well-developed to enable classification of the firms.

Key Constructs

International Business Orientation: The four categories of Bartlett & Ghoshal (1989) - global, transnational, international and multinational - were used as the basis for pre-interview questions to business and IT managers, and the rationale for the responses pursued at interview. The format of the questions was drawn from the work of Jarvenpaa & Ives (1993).

Business Strategy Emphasis: Data came from pre-interview responses on the extent to which the firm's strategy emphasised each of the following four strategic thrusts:

- Minimising costs in all areas
- Total customer service from any service point
- Flexibility to respond to new markets
- Continuous innovation through new product development

These were based on the work of Weill & others (1995) and the value disciplines of Treacy & Wiersema (CSC Index 1993, Treacy & Wiersema 1995).

IT Configuration: The four categories of IT configuration developed by Jarvenpaa & Ives (1993) to match the four international business orientations provided the basis for a pre-interview question to the IT manager.

IT Infrastructure Capabilities: Three measures were used to depict firm-wide IT infrastructure capabilities, drawing on the earlier work of one of the researchers in another set of 25 large firms (Broadbent & others 1996):

1. The number of IT infrastructure services which the firm had in place [see *Figure 3 in Section 3*]
2. The nature of the IT infrastructure services in terms of functionality [see *Appendix 2*]
3. The business functionality of the IT infrastructure in terms of reach and range (Keen 1991, Keen & Cummins 1994) as operationalised by Weill & others (1995) [see *Appendix 3*]

The data for these measures was obtained during the IT manager interview session, using the list of the services and a two dimensional grid to determine the extent of reach and range (Keen 1991).

Conduct of the Study

In two-thirds of the firms we were able to meet with two or more participants. All interviews were completed face-to-face on the firm's premises and ranged from 1.5 to 3 hours in length. In the remaining third of the firms it was possible to interview only IT executives due to clashing schedules with the business executives in the timeframe available for the site visits[4]. In each instance though, a senior executive with international business responsibilities completed the supplementary questions and returned these to the researchers. There were followed up with phone interviews where necessary. Following the interview sessions a descriptive case vignette was prepared on each firm using a standardised format to allow later comparisons between firms. To this was added the responses to the supplementary questions from business and IT managers. The vignettes (which ranged in length between 2,500 and 5,000 words each) were sent to participants to check for accuracy of facts and interpretation. The interview sessions, the pre-interview response forms, supplementary questions, internal documentation and case vignettes together provided multiple sources of evidence to enable triangulation of data and strengthen findings (Denzin 1970, Yin 1981, Miles & Huberman 1984).

We emphasise that although the selection of the firms was done on a careful and considered basis, the firms do not represent a sample for generalisability. Rather we have drawn on the literature and the experiences of 22 firms in four regions to better understand the interactions between international business approaches and IT infrastructure capabilities.

6. Linking International Business & It Infrastructure Capabilities

The spread of the 22 firms across three of the orientations, together with their distribution by industry, is presented in *Table 2*. Finance industry firms were predominantly *global* in their orientation, a greater while a

4 Managers for international operations tend to spend much of their time away from their domestic base.

greater percentage of the manufacturing firms were international and transnational. This reflects the different synergies sought in different types of firms and industries.

Table 2: International Business Orientations by Industry

INDUSTRY	INTERNATIONAL BUSINESS ORIENTATION		
	Global	*Transnational*	*International*
Finance/Banking	5	2	3
Manufacturing	5	3	4

We also found regional differences which appeared to be based largely on the pattern of international business developments amongst the firms studied. The firms in Singapore and Hong Kong were predominantly centralised in their business operations. Their growth had largely been in China and other parts of Asia. For the finance firms this was necessary since they had to provide services where their large customers were operating or expanding. In the case of the manufacturing firms, manufacturing operations had shifted to locations where labour costs were lower and were often in southern China, Indonesia, and Thailand. The firms headquartered in Japan and North America tended to have *international* or *transnational* orientations which were continuing to evolve.

We found evidence to support all five of the propositions amongst the 22 firms, although findings were uneven. Propositions were analyzed using Pearson Correlation Coefficients. Results showed that the measures of IT infrastructure capability, number of services and reach and range, were very strongly correlated. A summary correlation matrix is presented in *Appendix 4.*

Proposition 1: *Firms with different international business orientations will have different business strategy emphases.*

Business strategy emphasis varied amongst the three groups of firms: *global* firms placed strong and statistically significant emphasis on customer service (r=0.3,p=.08) and were negatively correlated on flexibility (r=-.3,p=.07), and innovation (r=-.5,p=.02); *transnationals* placed strong emphasis on innovation (r=.4,p=.04) and firms with an *international* orientation placed the highest emphasis on flexibility, though this was not statistically significant (see *Table 3*).

Table 3: Business Strategy and International Business Orientations

BUSINESS STRATEGY EMPHASIS	INTERNATIONAL BUSINESS ORIENTATION		
	Global	*Transnational*	*International*
	Customer	Innovation	Flexibility
	Cost	Flexibility	Innovation
	Flexibility	Cost	Cost
	Innovation	Customer	Customer

Proposition 2: The international business orientation of firms will match their IT configurations.
The three international business types in this study were strongly positively correlated with their matching IT configurations, and represented matched types in over 70% of firms (see *Table 4*). This result was somewhat higher than the 50% reported by Ives & Jarvenpaa (1991). All other combinations, other than *international* orientation with the multinational IT configuration, were negatively correlated (refer *Appendix 4*).

Table 4: International Business and IT Configurations

IT CONFIGURATION	INTERNATIONAL BUSINESS ORIENTATION		
	Global	*Transnational*	*International*
Global IT	7	-	-
Transnational IT	1	5	2
International IT	2	-	4
Multinational IT	-	-	1

There were three major explanations why business and IT configurations did not match in the other 30% of firms. First, some firms were in transition from, for example, an *international* to a *transnational* orientation,

and IT configuration changes were lagging behind business changes. Second, in some locations, the requisite skills or national telecommunications infrastructure were not available so pragmatic processes were put in place to manage IT differently in specific locations. Third, in some firms there was lack of realisation of the importance or relevance of meshing business orientation and IT configuration to deliver shared services more effectively. While the business changed, IT had not changed at the same pace or rate, resulting in a mismatched set of services and considerable frustration.

Proposition 3: Finance and manufacturing firms will differ in their IT infrastructure capability
Finance firms consistently offered a greater number of IT infrastructure services, with 80% of finance firms offering 16 or more services. This applied to all finance firms in Singapore (>20 services), Hong Kong (=> 20 services), and North America (=>16 services). In contrast, 83% of manufacturing firms offered 15 services or less, with 55% of this group offering 10 services or less (refer *Table 5*). This latter result is consistent with the inclination of many manufacturing firms to more locally focused, international operations.

Table 5: Industry and IT Infrastructure Capability

INDUSTRY	IT INFRASTRUCTURE CAPABILITY		
	=< 5 Services	*=< 15 Services*	*=> 16 Services*
Finance/Banking	0	2	8
Manufacturing	2	8	2

Total Possible Services = 23

Proposition 4: Firms with different international business orientations will have different patterns of IT infrastructure capability.
Both *global* and *transnational* firms had 16 of the 23 infrastructure services, while *international* firms had a significantly lower 12 services (r=-.32,p=.08) (see *Table 6*). Concurrently, *transnational* firms had a high reach and range (rr=653,r=.40,p=.03) while *international* firms had a lower reach and range (rr=411,r=-.35,p=.06). *Global* firms were strong in standards management (r=.40,p=.04), *transnational* firms in IT research and development (r=.43,p=.02), while *international* firms were negatively correlated with data management (r=-.51,p=.008), and standards management (r=-.36,p=.05). So while there was evidence to support the proposition, the evidence was not strong.

Table 6: International Business Orientation and IT Infrastructure Capability

	INTERNATIONAL BUSINESS ORIENTATION		
	Global	*Transnational*	*International*
Average Number of Infrastructure Services	16	16	12

Proposition 5: Firms with different IT configurations will have different patterns of IT infrastructure capability.

The IT configuration type is strongly related to different levels of IT infrastructure capability. As indicated in *Table 7*, the firms with a *global IT* configuration had the highest number of services (r=.55,p=.004) and this level of services was high across almost all areas of functionality. *Transnational IT* firms had the highest reach and range (rr=615,r=.41,p=.03) usually with a strong commitment to IT research and development (r=.52,p=.006). *International IT* firms were negatively correlated with both reach and range (r=-.41,p=.03) and with each infrastructure functional group (refer *Appendix 4*), and provided the fewest infrastructure services (r=-.78,p=.000). These differences in infrastructure service patterns are consistent with the balance between centralisation and dispersion of IT management in the four IT configurations.

Table 7: IT Configurations and IT Infrastructure Capability

	IT CONFIGURATION			
	Global IT	*Transnational IT*	*International IT*	*Multinational IT*
Average Number of Shared Services	20	16	6	15

Discussion

Business drivers (eg cost vs flexibility) and international orientation were linked to different IT configurations. These different approaches to managing IT revealed varying patterns of firm-wide IT infrastructure capabilities. A synthesis of the interactions between different international business environments and IT configuration and IT infrastructure capabilities is presented in *Table 8*.

Table 8: Business Pressures and IT Management Responses

International Business Orientation

International Information Pressures (High)		
	GLOBAL • Centralised IT Management • High Infrastructure Capability	TRANSNATIONAL • Federated IT Management • Selective Infrastructure Capability
	INTERNATIONAL • Dispersed IT Management • Limited Infrastructure Capability	MULTINATIONAL • Decentralised IT Management • Minimal Infrastructure Capability

Low — ***Local Responsiveness*** — High

Firms with a *global* international business orientation focused on customer service and cost advantages, and centralised their assets and capabilities on a global basis. Examples in our study included a number of the large banks headquartered in Singapore. *Transnational* firms aimed to achieve global flexibility, efficiency,

and the transfer of learning across firm. This required a complex balance of both interdependent and dispersed resources to meet pressures for international integration (in areas such as manufacturing and tracking of parts), together with being locally responsive, with modification of products or services at the country or regional level. Some similar complexities are experienced by firms with an *international* orientation where strategic focus is usually an adaption of parent company policies and practices in a mixed centralised/ decentralised structure, based on core competencies.

7. Management Mechanisms Of The Firms

The second focus of our work was to explore *how* firms managed these international business operations. Preliminary findings revealed many productive approaches. Examples of these approaches have been grouped into four areas: governance, investment, balancing, and learning experience mechanisms. We observed that a critical factor in each of these approaches was the IT management capabilities of the firms.

Governance Mechanisms

Firms which had matched their international business orientation, IT configuration and level of IT infrastructure capability tended to have governance mechanisms (Venkatraman, Henderson & Oldach 1993) involving one or more high level planning and decision-making committee with overlapping business and IT management membership. These Steering or Planning Committees or IT Councils are important in showing the transparency of the governance and management of IT responsibilities, and in representing the reality of the importance of IT to MNCs. For example, one of the firms in the study - the New York headquartered Citibank - delivers the 'Citibanking' experience to 20 million accounts in 41 countries. This requires a high level of international integration based on an 'anytime, anywhere' philosophy. The continuing development, integration and penetration of Citibanking requires the *'fusion of business and IT cultures'* said Citibank's Senior Technology Officer. To create this fusion of business and technology focus in the high priority consumer banking area, two overlapping committees which meet quarterly provide technology policy and oversight in the bank. The Global Consumer Council, chaired by the Senior Vice-President of Marketing, brings together the senior marketing managers, and includes the Senior Technology Officer amongst its members. A second group, the Global Consumer Technology Group, chaired by the Senior Technology Officer, brings together the senior technology managers from the consumer banking area and includes the senior marketing vice-president. The two groups have adjacent meeting times and some of their meetings are held jointly. This close and regular contact between marketers and technologists provides an ongoing avenue for the negotiation and informing of mutual expectations.

Investment Mechanisms

Firms, business units and their managers were often at different stages of appreciation of the role of IT in their business, and this made it difficult to link the context of the firms with appropriate infrastructure capabilities. In some firms, investment cases were used as educative mechanisms for executive and business managers, where there was limited understanding of the differential payoffs and thus justification approaches for different types of infrastructure investment (Weill, Broadbent & O'Brien 1995). In one rapidly expanding medium sized Asian bank, executive management was inexperienced in considering business cases for IT, particularly those involving shared infrastructure investments. International operations, requiring different types of shared services, were new to the bank. The IT Director had a carefully considered and crafted approach to educating the expectations of management: *'We are now in Stage 1 of an investment and education process . . . At present we hide infrastructure costs in business application cases. But the infrastructure building process is following a plan. I expect that in the next twelve months, the executives will have a much greater understanding . . . and the justification case for infrastructure can be made differently once they see what it delivers to the business'.* The expectations of executives was that each investment would have direct, specific and readily quantifiable business benefits. The IT Director was working to change those expectations over time to cope with the IT infrastructure demands of international expansion and was working sensibly and diplomatically to do so.

Balancing Mechanisms

Most firms had a number of balancing mechanisms (Brown & Ross 1995) which tended to firstly provide both structural overlays and process enhancements to assist infrastructure decision-making, and then implementation of pertinent types of capability. For example in some firms, the CIO had to countersign all large capital expenditure for business units and was responsible for presenting business unit large scale IT investment cases to the firm's executive committee. This conduit role enhanced the firm's ability to monitor the nature and location of IT infrastructure capability, and provided a sound base for development of further shared services (where advantageous). This role also gave the CIO additional influence in firms which had devolved IT responsibility to the business.

Integrating Learning Experiences Mechanisms

Joint planning committees, high level steering groups, the rotation of business and IT staff, and the devolution of applications development into business units contributed to the integration of business requirements and IT capabilities in many international firms. However, few had gone as far as the Canadian-based insurance firm Sun Life, in the formal integration of learning experience mechanisms. In addition to Canada, Sun Life has major operations in Great Britain, Ireland, the United States, the Philippines, and Hong Kong. The corporate IS function provides selected IT infrastructure capabilities in a firm with *international* orientation and IT configuration. Each National office has an IS group responsible for local infrastructure and applications development. This division of responsibilities is aimed at forcing close cooperation and greater creativity between business and IT staff.

Sun Life has well developed governance and balancing mechanisms, with interlocking business and IT committees at several levels of the business, and these are additionally complemented by learning experience mechanisms. Considerable effort is expended in recording and disseminating the deliberations of these groups and making the content and outcome readily accessible to both business and IT managers. The aim is to *'make the whole more than the sum of its parts'* by leveraging IT, sharing knowledge and fostering innovation internationally. IT is seen as cost-effective business investment and there is a high level of knowledge amongst business managers of the value that IT brings to the business. This knowledge in turn feeds into business expectations which are adventurous but informed, and able to be openly discussed and negotiated. A major contributor to this process since the early 1990s has been the President's annual review and the subsequent dissemination of 'lessons learned'. Each year, the President of Sun Life undertakes a personal review of a specific initiative in conjunction with, and advice from, the corporate IS planning group. These reviews result in the publication of 'lessons learned' documents which are distributed to all locations. Sun Life sees this as integrating learning experiences into the processes of the firm, regardless of where and how these learning experiences took place.

While these four mechanisms are relevant in many situations, their implementation in complex international environments engenders mutually informed expectations between business and IT management, assisting the match business requirements with IT infrastructure capabilities.

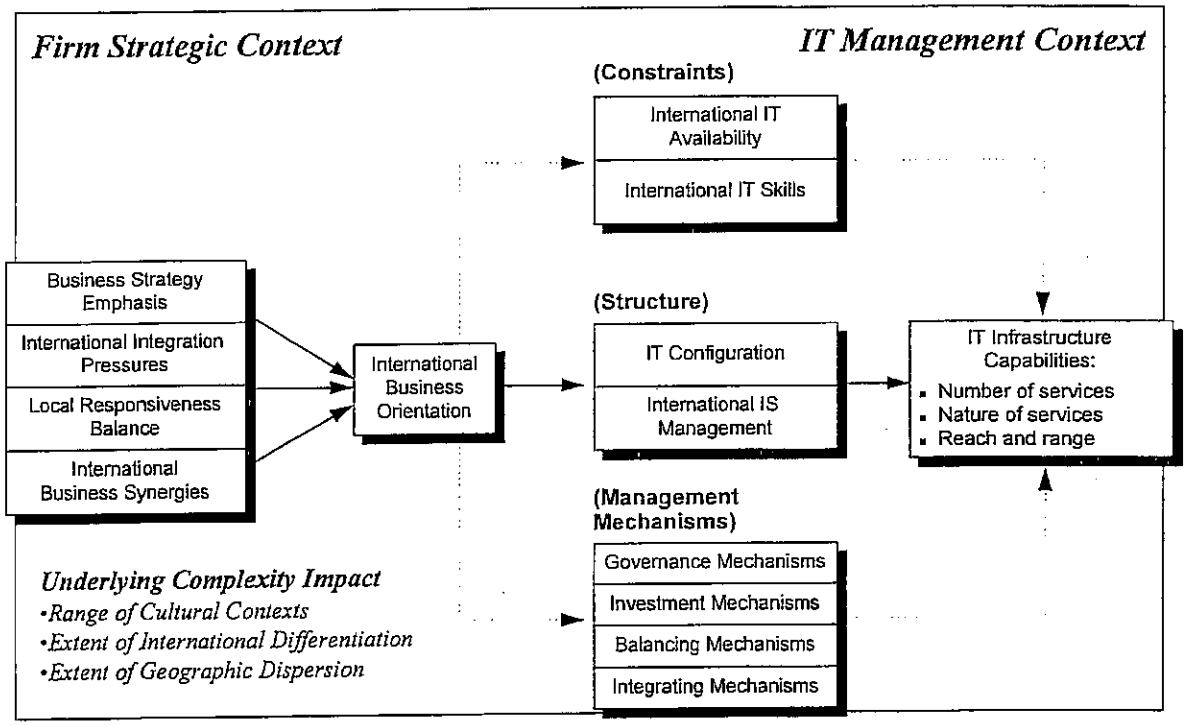
8. Implications For Research And Practice

While there is increasing emphasis on the importance of businesses being globally competitive, firms which have substantial operations outside their domestic base face major challenges in implementing the most appropriate global-local mix. These firms have to balance multiple factors in matching their strategic orientation and business strategy emphasis with their IT management approach and the development of appropriate IT infrastructure capability. Concurrently they have to consider the constraints in their operating environments, particularly the availability of local or specific technology expertise and the telecommunications infrastructures of the countries in which they were operating.

We have summarised and interpreted the dimensions of developing appropriate IT infrastructure capability into the framework presented in *Figure 4*. Characteristics of the strategic context of the firm which are important inputs to the firm's international business orientation include the firm's business strategy emphasis, the international-local responsiveness balance, and business synergies. International business orientation leads to specific IT configuration and approaches to international IT management. The IT management context of the firm is constrained by the availability of both IT components and skills and complemented by a series of management mechanisms. Governance, investment, balancing and integrating mechanisms are integral to implementing and sustaining IT infrastructure capabilities which in turn support and enable the firm's strategic context. Underlying complexity factors (which were not formally examined in this study)

include the range of cultural contexts (Hofstede 1984), the extent of international differentiation (Ghoshal & Nohria 1989) and issues associated with geographic dispersion.

Figure 4: Linking International Business Orientation and IT Infrastructure Capabilities



This framework provides a basis for further research into the implications of international business operations for the development and management of IT infrastructure capabilities. While some of the variables needed to test this framework have been well developed, others remain embryonic and provide a fertile ground for researchers (we have provided an initial basis only for further work). In identifying four management mechanisms which internationally operating firms use to develop and sustain appropriate infrastructure capabilities.

This research contributes to understanding how firms with extensive international operations develop and manage capabilities suited to their strategic context. The study has reinforced the complex nature of international business decision environments, and the criticality of integrating business and IT capability decision-making. We have explored new ground in utilising the notion of IT infrastructure capability as a way to express the IT requirements of different types of international business environments.

For managers, this study clarifies the different IT capability demands generated by different types of international business orientation. Managing IT for international operations will continue to present major challenges to both business and IT managers. However, a careful and considered review of four characteristics:

- business strategy emphasis
- pressures for international integration and local responsiveness
- potential synergies across businesses and locations
- the nature of a firm's international orientation (eg, *global, transnational, international, multinational)*

provides valuable input to the shape and configuration of future IT management including specifically the nature and extent of IT infrastructure capability required. The successful implementation of this capability requires a series of management mechanisms which encourage high levels of both managerial IT knowledge and the exchange of business-related and IT-related knowledge amongst executive, business unit and line managers. Our findings and the framework emphasise the interaction of many variables and the importance of taking a holistic and consistent perspective in linking aspects of firm strategic characteristics and IT capabilities.

References

Alavi, M. & Young. G. (1992) Information technology in an international enterprise: an organizing framework, in *The Global Issues of Information Technology Management*, Edited by S. Palvia, P. Palvia & R.M. Zigli. Harrisburg, PA: Idea Group Publishing, 495-516.

Allen, B. & Boyton, A. (1991) Information architecture: In search of efficient flexibility, *MIS Quarterly*, 15, December 1991, 435-442

Bartlett, C.A. & Ghoshal, S. (1989) *Managing across borders: the transnational solution.* Boston: Harvard Business School Press.

Bartlett, C.A. & Ghoshal, S. (1992) *Transnational management: text, cases, and readings in cross-border management.* Boston: Irwin.

Benbasat, I., Goldstein, D. & Mead, M. (1987) The case research strategy in studies of information systems, *MIS Quarterly*, 11:3, 369-388.

Boynton, A.C. & Zmud, R. (1987) Information technology planning in the 1990s: directions for practice and research. *MIS Quarterly*, 11:1, 59-71.

Bradley, S.P., Hausman, J.A. & Nolan, R.L. (1993) Globalization and technology, in *Globalization, technology, and competition: the fusion of computers and telecommunications in the 1990s,* Edited by S.P. Bradley, J.A. Hausman, & R.L.Nolan. Boston: Harvard Business School Press, 3-32.

Brancheau, J.C., Janz, B.D., & Wetherbe, J.C. (1996) Key issues in Information Systems Management: 1994-95 SIM Delphi Results, *MIS Quarterly*, 20:2, 225-242.

Broadbent, M., Butler, C. & Hansell, A. (1994) Business and technology agenda for information systems executives. *International Journal of Information Management*, 14:6, 411-426.

Broadbent, M., Weill, P., O'Brien, T. & Neo, B.S. (1996) Firm context and patterns of IT infrastructure capability, *Proceedings of the 17th International Conference on Information Systems (ICIS),* Cleveland, OH, on December, 1996.

Brown, C.V. & Ross, J.W. (1995) *The Information systems balancing act: building partnerships and infrastructure.* Center for Information Systems Research, Sloan School of Management, MIT, CISR WP No.277, Sloan WP No. 3792.

Buss, M. (1982) Managing international information systems, *Harvard Business Review,* September-October, 153-162.

Cash, J.I., McFarlan, R.W., McKenney, J.L. & Applegate, L. (1992) *Corporate Information Systems Management; text and cases.* 3rd ed. Boston: Irwin.

Cheung, H.K. & Burn, J.M. (1995) Managing distributed information systems resources in a globalized environment, in *Proceedings of the Sixteenth International Conference on Information Systems, December 10-13, Amsterdam,* edited by J.I. DeGross et al. ICIS, 255-269.

Clemons, E., Row, M, & Venkateswaran, R. (1989): The Bell Canada CRISP Project: A case study of migration of information systems infrastructure for strategic positioning. *Office: Technology and People*, 5:4, 299-315.

Copeland, L., & Griggs, L. (1985) *Going international: How to make friends and deal effectively in the global marketplace.* New York: Random House.

Couger, J., Borovits, I. & Zviran, M. (1989) Comparison of motivating environments for programmer/analysts and programmers in the U.S., Israel, and Singapore. *Proceedings of the Twenty-Second Annual Hawaii International Conference on System Sciences,* Vol IV, Washington, D.D.: IEEE Computer Society Press, 316-323.

CSC Index (1993) *Relating strategic positioning to information needs, Building the new information infrastructure,* Working Paper 1, London: CSC Index.

CSC Index (1994) *Critical issues of information systems management for 1994.* CSC Index, Boston, MA.

Dagwell, R. & Weber, R. (1983) Systems designers' user models: A comparative study and methodoligical critique, *Communications of the ACM,* 26:1, November 1983, 987-997.

Daniels, J.L. & Frost, N.C. (1988) On becoming a global corporation, *Stage-by-Stage 8,* No.5, Nolan Norton & Co, 1-14.

Deans, P.C., Karwan, K.R., Goslar, M.D., Ricks, D.A., & Toyne, B. (1991) Identification of key international information systems issues in US-based multinational corporations, *Journal of Management Information Systems,* 7:4, Spring 1991, 27-50.

Denzin, N.K. (1970) *The research art in sociology: a theoretical introduction to sociological methods,* London: Butterworths.

Doz, Y.L. & Prahalad, C.K. (1981) Headquarters influence and strategic control in MNCs, *Sloan Management Review,* Fall 1981, 15-29.

Duncan, N.B. (1995) Capturing flexibility of information technology infrastructure: a study of resource characteristics and their measure, *Journal of Management Information Systems,* 12:2, Fall 1995, 37-57.

Egelhoff, W.G. (1982) Strategy and structure in multinational corporations: an information processing approach, *Administrative Science Quarterly,* 27:3, 435-458.

Egelhoff, W.G. (1991) Information-processing theory and the multinational enterprise, *Journal of International Business Studies,* Third Quarter, 341-368.

Ein-Dor, P. & Segev, E. (1992) End User Computing: a cross cultural study, *International Information Systems,* January 1992, 124-137.

Eisenhardt, K.M. (1989) Building theories from case study research, *Academy of Management Review,* 14:4, 532-550.

Ghoshal, S. & Nohria, N. (1989) International differentiation within multinational corporation, *Strategic Managment Journal,* 10:4, July/August 1989, 323-337.

Gibson, R. (1994) Global information technology architectures, *Journal of Global Information Management,* 2:1, Winter 1994, 28-38.

Grover, V., Segars, A.H., & Durand, D. (1994) Organizational practice, information resource deployment and systems success: a cross-cultural survey, *Journal of Strategic Information Systems,* 32, June 1994, 85-106.

Hagstrom, P. (1990) New information systems and the changing structure of MNCs, in *Managing the global firm,* edited by C.A. Bartlett, Y.Doz & G. Hedlund, London: Routledge, 164-185.
Hall, E.T. & Hall, M.R. (1990) *Understanding cultural differences: Germans, French and Americans.* Yarmounth, Maine: Intercultural Press.
Hessler, P. (1993) Being global and global opportunity, in *Globalization, technology, and competition: the fusion of computers and telecommunications in the 1990s,* Edited by S.P. Bradley, J.A. Hausman, & R.L.Nolan. Boston: Harvard Business School Press, 243-256.
Hofstede, G. (1984) *Culture's consequences: International differences in work-related values.* Cross-Cultural Research and Methodology Series, Vol 5., Newbury Park, CA: Sage.
Huff, S. (1991) Managing global information technology, *Business Quarterly,* Autumn 1991, 71-75.
I/S Analyzer (1991) Building a Global IT Infrastructure, *I/S Analyzer,* 29 June, 1-16.
Ives, B. & Jarvenpaa, S.L. (1991) Applications of global information technology: key issues for management, *MIS Quarterly,* March, 33-49.
Ives, B., Jarvenpaa, S.L.. & Mason, R.O. (1993) Global business drivers: aligning information technology to global business strategy, *IBM Systems Journal,* 32:1, February, 143-161.
Jarvenpaa, S.L. & Ives, B. (1993) Organizing for global competition: the fit of information technology, *Decision Sciences,* 24:3, May/June, 547-580.
Jarvenpaa, S.L. & Ives, B. (1994) The Global network organization of the future: information management opportunities and challenges, *Journal of Management Information Systems,* 10:4, Spring, 25-57.
Johnston, H.R. & Carrico, S.R. (1988) Developing capabilities to use information strategically, *MIS Quarterly,* 12:1, March 1988, 36-48.
Karimi, J. & Konsynski, B.R. (1991) Globalization and information management strategies, *Journal of Management Information Systems,* 7:4, Spring 1991, 7-26.
Keen, P.G. (1991) *Shaping the future: Busienss design through information technology.* Cambrige, MA: Harvard Business School Press
Keen, P.G.W. & Cummins, J. M. (1994) *Networks in action: business choices & telecommunciations decisions.* Belmont, CA: Wadsworth. 1994.
Kefalas, A.G. (1992) Global information technology as a strategic weapon for MNCs: a conceptualization, in Palvia et al, eds., *The Global Issues of Inforamtion Technology Management,* Harrisburg: Idea Publishing Group, 608-629.
King, W.R. & Sethi, V. (1992) A Framework for transnational systems, in *The Global issues of information technology management,* Harrisburg, PA: Idea Group Publishing, 214-248.
Konsynski, B.T. & Karimi, J. (1993) On the design of global information systems, in *Globalization, technology, and competition: the fusion of computers and telecommunications in the 1990s,* Edited by S.P. Bradley, J.A. Hausman, & R.L.Nolan. Boston: Harvard Business School Press, 81-108.
Kumar, K. & Bjorn-Andersen, N. (1990) A Cross-cultural comparison of IS designer values, *Communications of the ACM,* 33:5, May 1990, 528-538.
Mandell, S.L. & Grub, P.D. (1979) Survey of multinational corporate computer-based information systems, *European Journal of Operatioal Research,* 3, 359-367.
Mandell, S.L. (1975) The Management Information System is going to pieces, *Californian Management Review,* 17:4, Summer 1975, 50-56.
Manheim, M.L. (1992) Global information technology: issues and strategic opportunities, *International Information Systems,* 1992, 38-67.
McKay, D. T., & Brockway, D. W. (1989). Building I/T Infrastructure for the 1990s, *Stage by Stage (Nolan Norton & Company),* 9:3, 1-11.
McKenney, J.L. (1995) *Waves of change: Business evolution through Information Technology,* Boston MA; Harvard Business School.
Miles, M.B. & Huberman, A.B. (1984) *Analyzing quantitative data: a source book for new methods,* Beverley Hills, CA: Sage.
Neo, B.S. (1991) Information technology and global competition, *Information and Management,* March 1991, 20, 151-160.
Niederman F., Brancheau J. C. & Wetherbe J. C. (1991): Information Systems Management Issues for the 1990's. *MIS Quarterly,* 15:4, December, 475-495.
Nolan, Norton & Co (1990) *Global networking study.* 5 vols. KPMG Peat Marwick & Nolan, Norton & Co.
O'Hara-Devereaux, M. & Johansen, R. (1994) *Globalwork: bridging distance, culture and time.* San Francisco: Jossey-Bass.
Phillips, L.W. (1981) Assessing measurement error in key informant reports: a methodological note on organizational analysis in marketing, *Journal of Marketing Research,* 18, 395-415.
Porter, M.E. & Millar, V. (1985) How information gives you competitive edge, *Harvard Busienss Review,* July-August 1985, 149-160.
Porter, R.E. (1972) An overview of intercultrual communication, in *Intercultural communication: a reader,* edited by L.A. Samovar and R.E. Porter. Belmont, CA: Wadsworth, 3-17.
Prahalad, C.K. & Doz, Y.L. (1987) *The Multinational mission.* New York: The Free Press.
Roche, E.M. (1992) *Managing information technology in multinational corporations.* New York: Macmillan.
Roche, E.M. (1996) Multinational corporations - the emerging research agenda, *Journal of Strategic Information Systems,* 5:2, June 1996, 129-147.
Sankar, C., Apte, U. & Palvia, P. (1993) Global information architectures: Alternatives and tradeoffs, *International Journal of Information Management,* 13, 84-93.

Sauter, V.L. (1992) Cross-cultural aspects of model management needs in a transnational decision support system, *The Global Issues of Inforamtion Technology Management,* edited by P. Palvia & others, Harrisburg: Idea Publishing Group, 332-355.
Selig, G.J. (1983) *Strategic planning for information resource management: a multinational perspective.* Ann Arbor, MI: UMI Research Press.
Shore, B. & Venkatachalam, A.R. (1996) Role of national culture in the transfer of information technology, *Journal of Strategic Information Systems,* 5:1, March 1996, 19-35.
Steinbart, P.J. & Nath, R. (1992) Problems and issues in the management of international data communications netowrks: The experiences of American companies, *MIS Quarterly,* 16:1, March 1992, 55-76.
Thompson, J.M., & Faigle, T.W. & Short, J.E. (1987) We *are* the world, *Information Stragtegy: The Executive's Journal,* 3:3, Spring 1987, 32-37.
Tractinsky, N. & Jarvenpaa, S.L. (1995) Information systems design decision in a global versus domestic context, *MIS Quarterly,* 19:4, December 1995, 507-534.
Treacy, M. & Wiersema, F. (1995) *Discipline of market leaders.* Reading, MA: Addison-Wesley.
Venkatraman, N., Henderson, J.C. & Oldach, S. (1993) Continuous alignment: exploiting Information Technology capabilities for comopetitive success, *European Management Journal,* 11:2, Summer 1993, 139-149.
Watson, R.T., Kelly, G.G., Galliers, R.D. & Wetherbe, J.C. (1996) Key Issues in Information Systems Management: An International Perspective, under revision for *Journal of Management Information Systems.*
Weill, P. (1993) The Role and value of information technology infrastructure: Some empirical observations, in *Strategic Information Technology management: Perspectives on organizational growth and competitive advantage,* Edited by R.D. Banker, R.J. Kauffman & M.A. Mahmood. Harrisburg, PA: Idea Publishing Group, 547-572.
Weill, P., Broadbent, M. & St Clair, D. (1996) IT value and the role of IT infrastructure investments, in *Competing in the information age: strategic alignment in practice,* Edited by J.Luftman. New York: Oxford University Press, pp. 361-384.
Weill, P., Broadbent, M. & O'Brien, T. (1995) Does IT infrastructure investment pay off?, *MIS,* December 1995, 28-30.
Weill, P., Broadbent, M., Butler, C. & Soh, C. (1995) Firm-wide Information Technology Infrastructure investment and services, *Proceedings, 16th International Conference on Information Systems,* Amsterdam, December 1995.
Yin, R.R. (1981) The case study crisis: some answers, *Administration Science Quarterly,* 26:1, 58-65.
Yin, R.R. (1994) *Case study research: design and methods.* 2nd ed. Thousand Oaks, CA: Sage Publications.
Yip, G.S. (1989) Global strategy . . . in a world of nations? *Sloan Management Review,* Fall, 29-41.

APPENDIX 1 PHASE ONE FIRMS AND DATA COLLECTION

Each of the four firms in Phase 1 had over 20,000 employees, annual revenues exceeding $US5bn and a substantial and growing presence in several Asian countries. Each firm gained at least 25% of their revenues from operations outside their Australian domestic base and had operations in at least 15 countries in a minimum of four continents. The distances between some operational locations and headquarters were at the geographical extremities of the globe. These firms constituted critical sites where the experiences of interest were expected to be most acute (Yin 1994).

Within each firm, multiple interviews were held with multiple business and IT participants (at corporate, SBU management and local levels executive business managers and IT managers) to identify the major challenges in providing IT infrastructure capabilities to international business operations vis-a-vis their domestic operations. These sessions were largely unstructured and aimed at surfacing strategic developments and locations which would highlight specific recent issues faced by the firm. One or two major business initiatives which had an impact on IT infrastructure then became the focus for the investigation. Onsite visits were made to major domestic and non-domestic locations for each firm between April 1994 and September 1995. A total of 41 participants were involved in interviews ranging from one to three hours. An extensive case study analysis report of between 4,000-8,000 words, was prepared for each company (and these subsequently provided the basis for the development of teaching cases). Each report was reviewed by all participants in a firm to ensure accuracy of facts and interpretation.

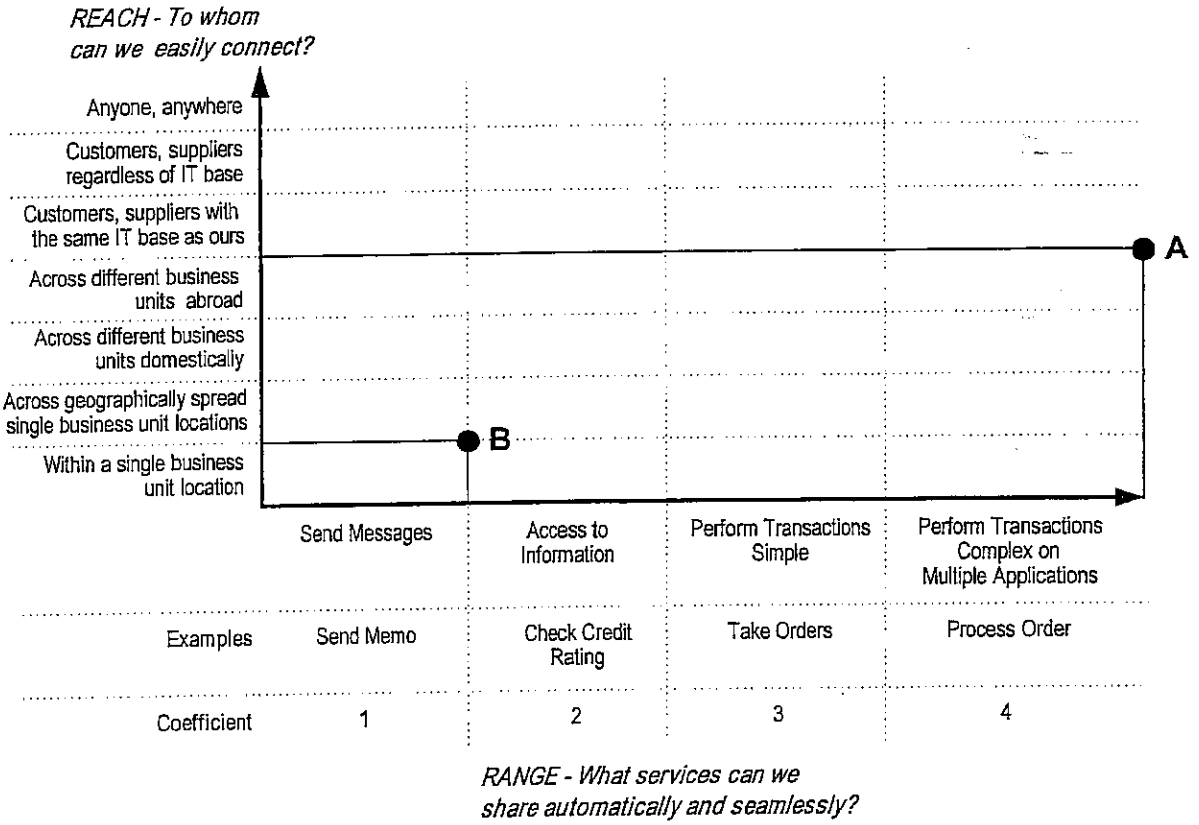
APPENDIX 2: IT INFRASTRUCTURE SERVICES GROUPED BY FUNCTIONALITY

Communications Management
1. Management of corporate communication network services
2. Management of group-wide or firm-wide messaging services
12. Management of business-unit specific networks (e.g. LANs)
Applications Management
7. Management of group-wide or firm-wide applications and databases
15. Development of business-unit specific applications (usually on a chargeback or contractual basis)
17. Electronic provision of management information (e.g. EIS)
18. Management of business-unit specific applications
20. Development and management of on-line and/or EDI linkages to suppliers or customers
21. Development of a common systems development environment
23. Multi-media operations and development (e.g. video-conferencing)
Data Management
9. Data management advice and consultancy services
19. Group-wide or firm-wide data management, including standards
Standards Management
3. Recommend standards for at least one component of IT architecture (e.g. hardware, operating systems, data, communications)
11. Enforcement of IT architecture and standards
IT Education Management
5. Technology advice and support services
22. Technology education services (e.g. training)
Services Management
6. Management, maintenance, support of large scale data processing facilities (e.g. mainframe operations)
8. Performing IS project management
10. Providing IS planning for business units
13. Managing and negotiating with suppliers and outsourcers
Security
4. Security, disaster planning and business recovery services for firm-wide installations and applications
16. Implementation of security, disaster planning and recovery for business units
IT R&D
14. Identification and testing of new technologies for business purposes

APPENDIX 3 IT INFRASTRUCTURE CAPABILITIES: REACH AND RANGE

The business functionality of firm-wide IT infrastructure can be defined in terms of "reach and range" (Keen 1991). A large reach and range indicates the firm is able to simultaneously perform transactions on multiple applications updating all databases across different business units - be they located locally, domestically or overseas (point A). For example, in an Australian firm with this level of reach and range, an overseas business unit could take an order, and process it through inventory, production, scheduling, and eventually accounts receivable, while automatically updating the corporate executive information system back in Australia. A large reach and range indicates the firm is favouring an Enabling view of IT infrastructure. A small reach and range supports the sending of standard messages within a single business unit location (point B).

Each firm's reach and range was plotted using the grid below. An algorithm was developed to convert the plot into a score ranging from 0 to 1000. This involved drawing a leading diagonal from the point of no reach and range to the point of maximum reach and range. A standard cubic function was used to calculate the number of cells from the leading diagonal to a given point on the grid. This distance was then multiplied by a coefficient weighting larger levels of range more highly as they are more difficult to achieve than reach.



APPENDIX 4 PEARSON CORRELATION COEFFICIENTS

	IT Configuration				Reach / Range	IT Infra Capable	Business Strategy			
	GLOBAL IT	TRANS IT	INTL IT	MULTI IT	R&R	INFRA	COST	CUSTOMER	FLEXIBILITY	INNOVATION
IBO Orientation										
Global	.7483 P= .000	-.5003 P= .009	-.1491 P= .254	-.1992 P= .187	-.0107 P= .481	.2214 P= .161	.0606 P= .400	.3249 P= .081	-.3495 P= .065	-.4481 P= .024
Transnational	-.3705 P= .045	.7174 P= .000	-.3321 P= .066	-.1183 P= .300	.3996 P= .033	.0892 P= .346	.0000 P= .500	-.1513 P= .262	.1469 P= .268	.3961 P= .042
International	-.4667 P=.014	-.1107 P=.312	.4582 P=.016	.3194 P=.074	-.3482 P=.056	-.3170 P=.075	-.0658 P=.391	-.2097 P=.187	.2406 P=.153	.1123 P=.319
Reach and Range										
Reach / Range	.1196 P= .298	.4069 P= .030	-.4084 P= .030	-.3339 P= .064	1.0000 P= .000	.5440 P= .004	.0623 P= .397	.1646 P= .244	.1045 P= .331	.0616 P= .398
IT Infrastructure Capability										
Infra	.5510 P= .004	.1863 P= .203	-.7847 P= .000	.0155 P= .473	.5440 P= .004	1.0000 P= .000	.0646 P= .393	.3779 P= .050	.1707 P= .236	-.1616 P= .248

	IT Infrastructure Service Groupings							
	COMMS	APPLICATIONS	DATA	STANDARDS	IT EDUCATION	IT MNGT	SECURITY	R&D
IBO Orientation								
Global IT	.1446 P= .260	.2218 P= .161	.2768 P= .106	.3849 P= .038	.2178 P= .165	.1588 P= .240	.1936 P= .194	-.2025 P= .183
Transnational IT	.0859 P= .352	-.0293 P= .449	.2368 P= .144	-.0508 P= .411	.0582 P= .398	.0544 P= .405	.0307 P= .446	.4312 P= .023
International IT	-.2318 P= .150	-.2108 P= .173	-.5089 P= .008	-.3658 P= .047	-.2853 P= .099	-.2188 P= .164	-.2346 P= .147	-.1714 P= .223
IT Configuration								
Global IT	.2682 P= .114	.5137 P= .007	.5326 P= .005	.6401 P= .001	.4832 P= .011	.5715 P= .003	.5244 P= .006	.0271 P= .452
Transnational IT	.2553 P= .126	.0808 P= .360	.2292 P= .152	.0590 P= .397	.1804 P= .211	.0759 P= .369	.1604 P= .238	.5241 P= .006
International IT	-.5514 P= .004	-.6291 P= .001	-.7674 P= .000	-.6535 P= .000	-.7915 P= .000	-.7650 P= .000	-.6640 P= .000	-.5095 P= .008
Multinational IT	-.0102 P= .482	.0098 P= .483	-.0794 P= .363	-.1704 P= .224	.1953 P= .192	.1826 P= .208	-.1234 P= .292	-.1816 P= .209